Kaynak Suyunun Ürik Asit Taşlarının Çözünülürlüğü Üzerine İnvitro Etkileri: Pilot Bir Çalışma

Invitro Effects of our Spring Water on the Solubility of Uric Acid Stones: a Pilot Study

Ürik Asit Taşlarının Çözünülürlüğü / The Solubility of Uric Acid Stones

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Özet

Amaç

Çalışmanın amacı ürik asit taşı oluşan hastalarında kaynak suyunun idrar bileşenleri ve taş örnekleri üzerine olan etkisini incelemekti.

Gereç ve Yöntemler

Ürik asit taşı olan 20 hastaya başlangıçta ve kaynak suyumuzu içeren kontrollü diyet sonrasında beslenme ve metabolik değerlendirme yapıldı. Taş örnekleri aynı zamanda musluk suyu ve kaynak suyuna maruz bırakıldı. Taş ağırlıkları inkübasyondan önce ve 7 gün sonrasında ölçüldü.

Bulgular

Kaynak suyu içen hastalarda ortalama idrar pH'sında artma eğilimi vardı ve değişim istatistiksel olarak anlamlı idi. Öte yandan, bu hastalarda idrar sitrat atılımı da istatiksel olarak anlamlı oranda artış gösterdi ($p<0.005$). Taş örneklerinin ilk ve son kuru ağırlıkları arasındaki fark da istatiksel olarak anlamlı idi ($p<0.05$).

Sonuç

Pilot çalışmamızın sonuçları, alkalik kaynak sularının ürik asit taş oluşumu ve rekürrensin azaltılmasına yardımcı olabileceğini düşündürmektedir.

Anahtar Kelimeler

Ürik Asit Taşı, Taşların Çözünürlüğü, Kaynak Suyu.

Abstract

Aim

The aim of this study was to evaluate the influence of our spring water on urinary analytes and stone samples in (patient with) uric acid stone.

Material and Methods

Twenty patients with uric acid stones underwent a nutritional and metabolic evaluation at baseline and after a controlled diet including our spring water. Stone samples were also left in the usual water and in the spring water. The weights of stones were measured before and 7 days after incubation.

Results

In patients who drank spring water, there was a tendency for the mean urine pH to increase, the change was significant statistically. On the other hand, urine citrate excretion significantly also increased in these patients ($p<0.005$). The differences between initial and end-dry weights of stone examples were significant statistically ($p<0.05$).

Conclusion

The results of our pilot study may help us to reduce uric acid stone formation and recurrence with the alkaline spring waters.

Keywords

Uric Acid Stone, Solubility of Stones, Spring Water.

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Introduction

Urolithiasis is still a disease with a high morbidity, the annual percent frequency increasing with the improvement in socioeconomic indices in the various countries through-out the world. In western society, due to the high standard of living, the incidence of urinary stones is progressively increasing. With the introduction of extracorporeal shock wave lithotripsy, the approach to the treatment of urolithiasis has changed. However, this treatment of choice because of safety and efficacy, we are still faced with the problem of possible recurrence. The solubility of uric acid stones has been studied in water solutions containing ammonium ions, alkaline ions and alkaline earth metals [1]. Oligomineral and spring waters were based upon historical studies which have shown its effect upon renal metabolism and the physiology of the urinary tract [2, 3]; diuretic effect, elimination in the same period of time of a larger amount of water and solutes than with usual water, effect upon the supersaturation of solutes, and effect upon crystallization inhibitors.

From the indications emerging from the studies [4 ,5], and considering that the risk of recurrence appeared to be correlated to the urinary dissoluble urate levels not only in patients presenting with the first episode of urolithiasis, but also in those who had experienced several episodes of recurrence, we attempted, in the present investigation, to evaluated whether urinary uric acid stones might be susceptible to statistically significant variations following in vitro treatment with our local a spring water.

Table 1. Concentration of components in the spring and usual water (mg/l)

	Spring water	Usual water
pH	8.1	6.5
Calcium	126.2	118.86
Magnesium	52	19
Sodium	5.3	47
Sulfate	350	442
Bicarbonate	1.500	228
Floride	0.05	0.03
Chloride	0.7	0.49

Material and Methods

20 idiopathic uric acid formers were enrolled in this study. 15 men a mean 49.7±10.4 years old with a mean body mass index 25.4±3.1 and 5 women a mean 48.3±11.5 years old with a mean body mass index 26.2±4.3 participated in the study. No patients had a history of a pathological condition, such as gout disease, hyperuricaemia or urinary tract infection. All patients had normal renal function. The standard protocol of this study included physical examination, a nutritional investigation, including a detailed 3-day food record and an interview by a dietician to determine customary dietary habits, and a metabolic evaluation [6]. The metabolic study was performed, and dietary records and interviews were obtained while patients adhered to their original diet as well as after 20-day periods of controlled diet during which they were asked to drink 2 L of spring water. The controlled diet provided a normal daily intake of calories, 1 g/kg protein. The diet was prepared by the dietetics serviced in our hospital. Patients were assigned to a random sequence of home diet with the usual amount and type of water ingested at home, and controlled diets with 2 L of spring water. Metabolic studies included measurement of plasma and urine creatinine, uric acid, sodium, potassium, chloride, calcium, phosphate and magnesium. The excretion of citrate was also determined in urine as well as pH and volume. Patients collected urine for 24h on 2 consecutive days. Crystalluria study was performed on a sample of fasting morning urine in all cases. Citrate was evaluated by enzymatic methods using commercially available kits. The stone samples (17 surgically removed, 3 spontaneously passed away) were pounded with pestle on a porcelain mortar in order to determine its chemical compositions. The stone samples were treated with the spring water and usual water (FS: 26, pH: 6.5). Concentration of components in the spring and usual water are given in Table 1. The stone examples were placed into bottles containing 100 millilitres of water and kept in room temperature for one week. They were mixed manually 3-4 for times a day and the initial and end-dry weights of the stones were calculated.

The statistical analysis was calculated by using student's t test.

Results

During the study period patient clinical characteristics, including weight, body index and age, did not differ significantly from those at baseline. The results of analytes in the plasma and urine evaluated at baseline and after the period of controlled diet showed no significant differences between the two groups. When patients drank the spring water, there were no statistically significant differences in plasma analyte values. More modifications of some urinary parameters were observed when they drank spring water. There was a tendency for the mean urine pH to increase after the ingestion of the spring water the change was significant statistically. In fact, citrate excretion increased after ingesting the spring water (statistically significant, Table 2).

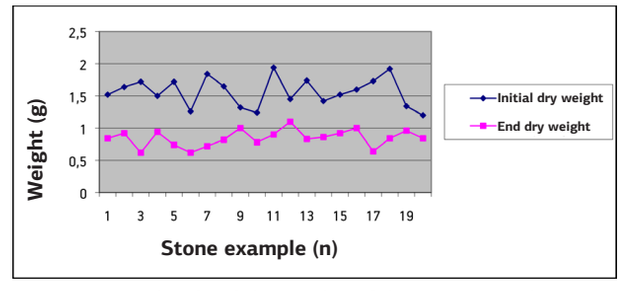

Figure 1. Initial and end-dry weights of the stone examples (g)

Table 2. Baseline and poststudy urinary composition of patients (Mean ±SEM).

		Poststudy	
	Baseline	Usual water	Spring water
Uric acid (mg)	503.4 ± 29.9	523 ± 24.3	508.7 ± 22.2
Citrate (mg)	560 ± 5.2	543.8* ± 6.8	756* ± 9
pH	5.91 ± 0.18	5.7* ± 0.03	6.2* ± 0.03
Volume (l)	2.4 ± 0.15	2.34 ± 0.02	2.36 ± 0.02
Sodium (mEq)	178.5 ± 11.2	159.9 ± 13.7	163.8 ± 12.7
Potassium (mEq)	62.1 ± 4.1	59.3 ± 2.9	57.3 ± 3.8
Calcium (mg)	232.9 ± 23.8	228.7 ± 26.4	235.5 ± 22.4
Chloride (mEq)	140.7 ± 12.1	148.8 ± 13.2	160.1 ± 17.2
Phosphate (mg)	925.7 ± 62.2	922.4 ± 57.5	937 ± 60.4
Magnesium (mg)	94.2 ± 7.56	92.1 ± 8	95.4 ± 6.9

*p< 0.05

The distribution of initial and end-dry weights of urate stone examples in usual water and the spring water are shown in Figure 1. According to these results, statistically significant differences were observed between initial and end-dry weights of stone examples (p<0.05).

Discussion

In current medical practice urinary stone formers are usually advised to drink a large amount of water whether or not medical treatment is given. The various types of spring water can be advised to the patients with urolithiasis [7, 8]. Their therapeutic efficacy is attributed, fundamentally, to the important diuretic effect, the litholytic effect, the modification in urinary pH and to the effect upon ureteric contractility [19, 10]. Of the various spring water available in our region, the choice of our spring water which contains bicarbonate, sodium, chloride and sulphur has been examined for possible effects on reducing recurrence of uric acid stone. It has been shown that the solubility of uric acid stones depends on the concentration of alkaline ions [11].

The results of this study show the influence of our spring water on some urinary factors for stone formation independent of the diluting effect of increased water intake. In fact, in our patients the urinary volume throughout the study period remained similar to high baseline values. Citrate excretion was increased during the initial controlled diet period, when patients drank the spring water. To avoid the possible influence of different dietary regimens, patients remained on a controlled diet during the study. In our series the spring water which has particularly rich in bicarbonate caused significantly increased urinary citrate excretion compared with baseline. This increase in citrate excretion may be modulated by gastrointestinal alkali absorption. Thus, evaluation of net gastrointestinal absorption of alkali may useful for this conclusion. On the other hand, after drinking the water, the urine seemed to be more alkaline, which was significant statistically. In addition to this, the solubility of the stone examples increased when the examples were treated with spring water significantly. These observations indicate that the spring waters rich in alkaline ions may increase the urinary excretion of citrate increasing the inhibitory power of urine against the risk of uric acide stone formation and even also decrease stone recurrence.

In conclusion, the results of our study help us to reduce uric acid stone formation and recurrence with the alkaline spring waters. However, this pilot study may stimulate other studies in a fairly large group of patients with uric acid urolithiasis to establish a true correlation between possible risk factors and recurrence.

References

1. Bilobrov VM, Bogdan NM, Bilobrov S, Roy A. Influence of cations and total protein of urine on the solubility and probability of urate stone formation in kidneys. Urol Int 2002;68:118-21.
2. Messina B. Fisiopatologia del rene e cure idropiniche. Clin Ter 1970;23:11-25.
3. Messina M. Ricerche sulle acque oligominerali di Fiuggi 1968-1976. Rome, Ente Fiuggi,1977.
4. Di Silverio F, D'Angelo AR, Gallucci M, Casanelli A, Lorenzi L, Seccareccia F, Menotti A. Incidence and prediction of stone recurrence after lithotripsy in idiopathic calcium stone patients:A multivariate approach. Eur Urol 1996;29:41-6.
5. Di Silverio F, Ricciuti GP, D'Angelo AR, Fraioli A, Simeoni G. Stone recurrence after lithotripsy in patients with recurrent idiopathic calcium urolithiasis: Efficacy of treatment with Fiuggi water. Eur Urol 2000;37:145-8.
6. Caudarella R, Rizzoli E, Bufa A, Bottura A, Stefoni S. Comparative study of the influence of 3 types of mineral water in patients with idipathic calcium lithiasis. Journal of Urol 1998;159:658-63.
7. Pytel' IuA, Aliaev IuG, Rapoport LM, Rudenko VL. Mineral water Volzhanka from Undorovski spring in combined therapy of patients with nephrolithiasis and chronic pyelonephritis. Urologia 1999;5:12-4.
8. Trinchieri A, Boccafoschi C, Chisena S, De Angelis M, Seveso M. Study of the diuretic efficacy and tolreability of therapy with Rocchetta mineral water in patients with reccurent calcium kidney stones. Arch Ital Urol Androl 1999;71:121-4.
9. Di Silverio F, Zaio A, Gallucci G. Treapia idropinica con acqua di Fiuggi nella calcolosi renale metabolica. Act Med Roma 1991;1:53-73.
10. Spada S, Cordelli A, Grassi M. Modificazioni del tempo di transito attraverso l'uretere di pseudocalcoli in conigli trattati con un'acqua oligominerale. Clin Ter 1968;21:559-65.
11. Bilobrov VM, Fedotova OO. Uric acid stones dissolution in water solutions. Dokl An UkrSSR 1990;B5:60-1.